

AUTOMATIC QUESTION DETERMINATION LEVEL BASED ON OBE
USING BRUTE FORCE STRING MATCHING

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ABSTRACT

Applying outcome-based education (OBE) in teaching and learning at the tertiary education level has become an important initiative in Malaysia as taken by the government. However, since the concept of OBE is relatively new, some lecturers face difficulty in evaluating the level of question that they produce. Hence this research aim is to develop an automatic question determination level based on OBE using brute force string matching prototype. The focus on this system is to generate a final exam question template with specific fonts and spacing and to evaluate the level of final exam question based upon the teaching and learning taxonomy published by UPM using string matching technique. The major findings that emerged are as follows: a) the suitable string matching technique to be use is brute force string matching due to the nature to the system and development constraints, b) all the outcomes are categorized into two main domains, including the Cognitive and Psychomotor domains. Furthermore, the development process is done using waterfall model software development life cycle. In conclusion, this system is to help user reduce the process and the workload of generating a final exam template.

ABSTRAK

Menggunakan hasil berasaskan pendidikan (OBE) dalam pengajaran dan pembelajaran di peringkat pengajian tinggi telah menjadi satu inisiatif penting di Malaysia seperti yang diambil oleh government. Walau bagaimanapun sejak konsep OBE agak baru, beberapa orang pensyarah menghadapi kesukaran dalam menilai tahap soalan yang mereka produce. Oleh itu tujuan kajian ini ialah untuk membangunkan tahap penentuan soalan automatik berdasarkan OBE menggunakan kekerasan perkataan kasar sepadan prototaip. Fokus sistem ini adalah untuk menjana peperiksaan akhir template soalan dengan fon tertentu dan spacing and untuk menilai tahap soalan peperiksaan akhir berdasarkan pengajaran dan pembelajaran taksonomi diterbitkan oleh UPM menggunakan teknik padanan tali. Penemuan utama yang muncul adalah seperti berikut: a) tali sesuai teknik yang sepadan untuk digunakan adalah kuasa perkataan kasar yang hampir sama kerana sifat sistem dan kekangan pembangunan, b) semua hasil dikategorikan kepada dua bidang utama termasuk kognitif dan domain psikomotor. Tambahan pula proses pembangunan dilakukan dengan menggunakan model air terjun perisian kitaran hayat pembangunan. Kesimpulannya sistem ini adalah untuk membantu pengguna mengurangkan proses dan beban kerja menjana template peperiksaan akhir.

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LIST OF ABBREVIATIONS

- UMP - Universiti Malaysia Pahang
UPM - Universiti Putra Malaysia
OBE - Outcome-Based Education

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CHAPTER 1

INTRODUCTION

1.1 Research Background

The move towards applying outcome-based education (OBE) in teaching and learning at the tertiary education level has become an important initiative in Malaysia as taken by the government. Through Board of Engineers, Malaysia (2009) has admitted to Washington Accord; which is a multinational agreement which recognizes the substantial equivalency of engineering degree programs. One of the key requirements for full membership of the Accord is to fully employ elements of outcome-based education.

The focus to attain certain specified results in terms of individual student learning is the educational approach of OBE. The achievement program needed to measure so that continues improvement can be done to upgrade the quality of graduates. All the outcomes are categorized into three main domains, including the Cognitive, Psychomotor and Affective domains.

The cognitive domains describe knowledge and the development of student's intellectual skills. These domains consist of six major classes starting from the simplest conduct (understanding) to the most intricate (evaluation). Furthermore, the psychomotor domain expresses the physical or technical skill that should be achieved by each student. This skill includes of coordination, physical movement and use of the motor skill areas and so forth. Progress of these skills involves practice that is measured in terms of techniques,

distance, precision, speed, or procedure. The skill evaluates the range from perception (lowest skill) until to origination (highest skill).

Affective domains define the object emotionally, for example, appreciation, motivation, enthusiasms, feelings, attitudes, and values. In the recent practices, affective domains will evaluate together with other soft skills elements such as leadership, team working, communication skills, critical thinking and etc.. However, in this study we do not consider other assessments, which are normally happened in the offered courses except for final exam. In this study, we do not consider these following soft skills elements as elements of final exam questions. If these questions are available, we will group it as an affective domain question.

Advantage of OBE to be implemented at in the university will always alert and concerned about the quality of the graduate produced through the development of more systematic, innovative and flexible teaching methods. Increase in student exposure to professional practice through industrial training, site visits and industry linked projects or assignments will be encouraged.

UMP as a one of IPTA's at Malaysia has enforced by MOHE to adopt OBE in the teaching and learning activities, specifically in preparing teaching and assessment materials. Beside UMP, there are others IPTA's that has adopted successfully this OBE in their curriculum such as UPM, USM, UNIMAS, UM and etc. As a new university, UMP has chosen UPM as a model to develop own OBE approach in the campus. As a result, OBE has started implemented at UMP since 2006. Until now, UMP has adopted teaching and learning taxonomy guideline published by CADe, UPM in developing teaching and learning material. Thus, this project will employ the same material as a guideline in order to evaluate the level of questions.

1.2 Problem Statement

Since the concept of OBE is relatively new, some lecturers face difficulty in evaluating the level of question that they produce. As instances, FSKKP decided that final exam question must consist of at least 60% cognitive according to different program with its required level; diploma programs are at C3 level while degree programs are at C4 level. As consequences of difficult to get the same idea and understanding in evaluating the question level, a proper guide is urgently needed to ensure the standard and quality of final exam paper is acceptable.

In producing the high standard quality of final exam paper, some lecturer too focuses on the questions itself and may neglect the formatting issues. It is also because of the process is quite tedious. The final exam template generator will help lecturers to focus more on producing quality questions and leave the formatting issues to the generator.

1.3 Objectives

The goals to be achieved on the project are the following:

- i. To study string matching technique in order to evaluate the level of questions.
- ii. To develop a prototype that will generate a final exam question template with standard fonts and spacing.
- iii. To evaluate the level of the final exam questions according to the teaching and learning taxonomy published by UPM using string matching.

1.4 Scope

The boundary of the project and users are as follow:

- i. The template consists of two types of exam question, which are structured and essay questions.
- ii. Implementation of teaching and learning taxonomy is published by Center for Academic Development (CADE), UPM in the system.
- iii. Two main domains, including the Cognitive and Psychomotor domains.
- iv. Generate PDF templates that consist of final examination paper, schema for final examination paper and OBE report for the final examination paper.

1.5 Thesis Organization

This thesis consists of six (6) chapters. Chapter 1 Introduction, is to give awareness to the readers about the propose topic. Chapter 2 Literature Review, purpose of this chapter is to explain about the selected project. Next Chapter 3 Methodology will discuss the overall approach and framework of research. Chapter 4 Design and Implementation are to develop the framework and model through flow work. Further on, record all the processes involved in research development and describe how it was structured. Chapter 5 Result and Discussion, will explain about the findings or the results from the data analysis. Lastly, Chapter 6 Conclusion, to make a summary for research that has been done.

1.6 Conclusion

The problems faced by lecturers in generating final exam template with quality standards, has motivated the development of automatic question determination level based on OBE using brute force string matching hence should be implemented and applied in the related sector. Furthermore, if the system is successfully implemented it will promote Malaysia's quality education to a higher-level competing internationally equally among other renown universities.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The practice of judging the worth as an individual is called an assessment, while educational assessment involves evaluating and collecting data evolving from planned learning programs or activities. The assessment in University Malaysia Pahang composes of 60% carry marks and 40% final exam. Carry marks consist of cumulative marks from lab sheet, assignment, test and etc.

An assessment practice that is gaining reputation is standards based assessment, which involves measuring student's ability on well defined course objectives (Tomlinson and McTighe, 2006). Standardized assessment is advantageous for several reasons. First of all, it can yield quantifiable information that can be used to screen out students who in need of further assessing. Information following the student's areas of strength and weakness are provided. Lastly, the most important of results is to be interpreted and ideas about an individual's skills are generalized. In Malaysia, standardized assessment is applied with outcome-based education (OBE).

The employment of elements of Outcome-Based Education has earned Malaysia full rights of participation in the Washington Accord. The responsible bodies in each of the current signatory countries will distinguish the substantial equivalency of engineering degree programs with this multinational agreement. Graduates of accredited programs are equally recognized as has to achieve the academic requirements for admission to carry out.

engineering practices in any constituent country as advised by the significant essentials of the agreement. Organizations of each member country have recognized graduates from accredited programs are ready to perform engineering at the entry level. This culture transformation without doubt contributed very significantly towards the growth of quality assurance for graduate outcomes (Basri and et.al, 2008).

2.2 Outcome Based Education

Assessment with OBE is done by respective institution to reflect the process of Continuous Quality Improvement (CQI). Outcomes of OBE are in the grounding of graduates for professional practice. Furthermore, rather than focusing on the process in achieving the results it requires documented proofs on how the programme conveys and builds up although this may be equally significant. The demonstration of that the graduate has achieved the required outcome is a vital part of the approach of the OBE programs. The outcomes are categorized into three main domains, including the Cognitive, Psychomotor and Affective domains.

2.2.1 Cognitive

The cognitive domains describe understanding and the growth of student's mental skills. These domains consist of six levels beginning from the easiest behavior (understanding) to the most intricate (evaluation). The six (6) levels of cognitive domain are as follows (Madya and Jantan, 2009):

- i. **Knowledge:** identify or recall data.

Examples of applied terms: define, describe, recall, recognize, remember, knows, what, names, when, list, selects.

- ii. **Comprehension:** express that the student has adequate knowledge to organize and sort out the matter mentally.

Examples of applied terms: converts, compare, contrast, rephrase, distinguishes, infers, interprets, paraphrases, summarizes.

- iii. **Application:** Obtaining an answer from a question that can relate to knowledge gain beforehand.

Examples of applied terms: apply, use, employ, separates, classify, analyzes, outlines, choose, solve how many.

- iv. **Analysis:** Advance order of questions that involves students to have in dept critical thinking. The students are asked in cognitive practices for analytic questions, for example: identify the cause of a specific events, analyze and consider existing data to reach a conclusion or generalization,

Examples of applied terms: determine, support, identify causes, evidence, illustrate conclusions, analyze, why.

- v. **Synthesis:** Advance order of questions that involves students to have new and creative thoughts. In questions, students are asked to make predictions, generate new communications, and solve problems. This type of question accepts the different variety of creative answers.

Examples of applied terms: predict, combines, write, designs, develop, synthesize, and construct, tells, reconstructs, revises, modifies.

- vi. **Evaluation:** Advance order of questions that does not have only an accurate answer. It involves students to a critic the value in an idea or the key to a

problem. The student may in addition be asked to present an outlook on the topic. In synthesis, questions may be used to initiate a class dialogue, as this type of question allows students to realize there are a variety of opinions on the subject.

Examples of applied terms: compares, interprets, justifies, summarizes, concludes, and criticizes.

2.2.2 Psychomotor

The psychomotor domain incorporates the use of motor-skill area, coordination, and physical movement. Improvement of these skills involves practice and is judge in terms of technique's implementation, range, process, speed or accuracy (Simpson, 1972). The skills evaluate the range from perception (lowest skill) until to origination (highest skill). The seven (7) levels of psychomotor domain are as follows (Madya and Jantan, 2009):

- i. **Perception:** The skills to detect signals from stimulus to guide motor activity. This ranges from conversion, cue selection, and sensory stimulation.

Examples of applied terms: chooses, describes, detects

- ii. **Set:** The emotional, physical, and mental sets to act with eagerness. These three sets are characters that predetermine a person's reaction to divers' circumstances.

Examples of applied terms: begin, displays, explains, moves, proceeds, react.

- iii. **Guided Response:** The early phases in becoming skilled at an intricate skill that involves imitation and test and fault couple with carry out led to achieve better presentation.

Examples of applied terms: copies, traces, follows, react, responses.

- iv. **Mechanism:** The immediate phase in educating physical ability with the outcomes that is habitual with a medium intensity of assurance and expertise.

Examples of applied terms: assembles, constructs, dismantle, displays, grinds, and organizes.

- v. **Complex Over Response:** The adept performance of motor acts that engage intricate movements that are achievable with a least amount of wasted attempt and a high level of assurance to be successful.

Examples of applied terms: heats, manipulates, measures, sketches.

Note: the terms maybe similar as mechanisms but will have adjectives or adverbs that point out that the performance is faster, enhanced, precise, etc.

- vi. **Adaptation:** movements that can be adapted in support of special environments.

Examples of applied terms: adapts, alters, changes, rearranges.

- vii. **Origination:** fresh movements can be formed for particular situations. Learning outcomes focuses on vastly developed skills with creativity.

Examples of applied terms: arranges, build, combines, originates.

2.2.3 Affective

The affective domain involves the behavior in which we deal with things emotionally, for instance, attitudes, appreciation, motivations, values, enthusiasms, and feelings. (Krathwohl, Bloom, Masia, 1973). The five (5) levels of affective domains are as follows (Madya and Jantan, 2009):

- i. **Receiving:** The concern is that the student's concentration is focused. The student passively attends to certain phenomena or stimulus projected outcomes include the student's responsiveness, listens attentively, listens considerately, shows understanding to social problems.

Examples of applied terms: sits erect, points to, chooses, identifies, asks, locates, etc.

- ii. **Responding:** The student actively participates, not only attends to the stimulus but responds in some manner. Learning outcomes focuses on take pleasure in aiding others, follows rules, participates in class conversation, finishes homework, show interest in subject, etc.

Examples of applied terms: writes, discusses, performs, complies, answers, presents, assists helps, practices, reads, etc.

- iii. **Valuing:** The significance of the student attaches to a certain entity, occurrence, or behavior. It varies from acceptance to commitment for example such as assuming accountability for the functioning of a crowd; attitudes and gratitude. Learning outcomes focuses on demonstration confidence in democratic development, values the part of science in everyday life, shows apprehension for other's wellbeing, etc.

Examples of applied terms: shares, explains, proposes, initiates, differentiates, justifies, and etc.

- iv. **Organization:** developing a philosophy of life, conveying together different significances, and starting to put up an internally reliable value system comparing, resolving disagreements amid them, relating and synthesizing values. Learning outcomes focuses such as recognize the necessity for equilibrium involving liberty as well as responsibility in a democracy, and admits responsibility for personal actions, etc.

Examples of applied terms: compares, arranges, integrates, combines, generalizes, modifies, organizes synthesis, etc.

- v. **Characterization by a Value or Value Complex:** At this stage, the person has detained a value coordination that has organized his manners for an extended time that a characteristic has been produced. Actions are predictable, consistent and pervasive. Learning outcomes focuses are concerned with social, personal, and emotional amendment: maintains fine health practice, cooperates in group activities, displays self confidence in working independently, etc.

Examples of applied terms: acts, displays, listens, perform.

2.3 Technique for String Matching

This section within the document describes three different string matching techniques in detail, which are suitable to be adapted in this project. The techniques are latent semantic analysis for text based, Boyer Moore string search algorithm and brute force string searching.

2.3.1 Latent Semantic Analysis for Text Based

LSA is a technique in natural language processing; a statistical model of word handling that allows assessments of semantic resemblance between pieces of textual information. It was developed to progress towards the effectiveness of information retrieval by performing retrieval based on the derived "semantic" contents of words in a query hence avoiding some problems of synonymy.

To examine the text, LSA first generates a matrix of occurrences of each word in each document (sentences or paragraphs), then uses singular value decomposition (SVD). SVD a technique strongly linked to eigenvector decomposition and factor analysis. It is a mathematical technique; a matrix containing word counts per paragraph is constructed from a large portion of text. The function is to decrease the number of columns while preserving the similarity structure among rows. Words are then evaluated by taking the cosine of the angle between the two vectors formed by any two rows. Value close to 1 corresponds to very alike terms while values close to 0 represent very different terms. (Dumais, 2005).

LSA does need a great quantity of text in order to carry out the SVD analysis. Typically, 200 contexts would be the minimum needed. LSA required a vast amount of processing power, plus the majority's analysis is currently performed on UNIX workstations. Furthermore, LSA cannot capture polysemy (words of multiple meanings). However, this method is automatic and swift, allowing fast measurements of the semantic similarity between pieces of textual information (Foltz, 1996).

2.3.2 Boyer Moore String Search Algorithm

Robert S. Boyer and J Strother Moore developed this BM algorithm in 1977 and have set the standard for practical string search literature as a competent string searching algorithm. It is based on the unconventional idea to start comparing characters at the end of the pattern rather than the beginning. (Wirth, 1985)